"EFFECTS OF COMBINED EXERCISE TRAINING ON BALANCE OF HEMIPARETIC STROKE PATIENTS"

Submitted by

271620161

Dissertation

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Coimbatore, Tamilnadu, India.

MARCH – 2018

CERTIFICATE

The work embodied in the thesis entitled "**EFFECTS OF COMBINED EXERCISE TRAINING ON BALANCE OF HEMIPARETIC STROKE PATIENTS"** submitted to the **Tamil Nadu Dr.MGR Medical University, Chennai** in partial fulfillment for the degree **of Master of Physiotherapy,** was carried out by candidate bearing register number **271620161** at Cherraan's college of physiotherapy, Coimbatore under my supervision. This is an original work done by him and has not been submitted in part or full for any other degree/diploma at this or any other university/institute. The thesis is fit to be considered for evaluation for award of the degree of Master of Physiotherapy.

Signature of Supervisor
Prof.Mr.V.Gobinath.,
MPT., MIAP.
Date:_____

Signature of Principal
Prof.Mrs.E.Selvarani.
MPT., MIAP.
Date:_____

Internal Examiner:_____ **External examiner:_____**

Project work evaluated on: _____

DECLARATION

The work embodied in the thesis entitled "**EFFECTS OF COMBINED EXERCISE TRAINING ON BALANCE OF HEMIPARETIC STROKE PATIENTS"** Submitted to the **Tamil Nadu Dr.MGR Medical University,Chennai** in partial fulfillment for the degree of **Master of Physiotherapy,**was the original work carried out by me and has not been submitted in part or full for any other degree / diploma at this or any other university / institute. All the ideas and references have been duly acknowledged.

_____ _____

Signature of supervisor **Signature of student**

Prof.Mr.V.Gobinath.,

MPT., MIAP.

Date_____

ACKNOWLEDGEMENT

I thank god almighty for thee never ending support and guidance throughout this project. The most worthy to receive glory, power and honour.

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Date :

Place: Signature of the candidate

271620161

INTRODUCTION

A stroke occurs as a result of brain damage caused by cerebral infarction or hemorrhage. The majority, 73~88%, of cerebral infarction patients have impaired sensory motor ability on the side opposite to the brain damage appearing as hemiplegia of the arms and legs or either[1]. Most survivors of stroke have decreased capacity to perform activities of daily living (ADL) because of a combination of sensory, motor, cognitive and emotional impairments[2]. Of all the possible sensorimotor deficits of stroke, damaged postural control has the greatest impact on ADL independence and gait[3].

Hemiplegic patients have decreased balance control ability. Especially, the postural sway in static positions is more than twice that of healthy subjects of the same age group, which consequences for safety[4]. Balance is described as the ability to maintain equilibrium in a gravitational field by keeping or returning the center of body mass over its base of support[5]. Dynamic balance is a voluntary response which maintains the position in response to an external perturbation[6].

Stroke patients with both motor and sensory deficits show high incidences of falls both during rehabilitation and thereafter due to loss of postural control[7].Many methods for improving the balance of stroke patients have been studied. An exercise program which promote weight bearing by the hemiplegic lower extremity was prescribed for stroke survivors by physical therapists[8,9]. Functional strengthening training enhances the interaction of the nervous and muscular systems, maximizing functional regulation to improve ADL[10]. Task oriented functional training on weight-bearing was especially effective[11, 12].

In Frenceshini and colleagues' study[13], stroke patients' trunk control ability improved after treadmill gait training, which to improved balance ability. When stroke patients performed standing in functional strengthening training, the rate of weight bearing on the affected side increased, improving their balance ability[11].

In the study of Katz-Leuer and his colleagues[14], the balance of stroke patients was improved by bicycle training. Based on the available evidence, the best therapeutic approach to influence the speed or extent of standing balance recovery in the subacute phase of stroke is controversial[15]. Physiological approaches and intervention methods have been studied for rehabilitation of stroke patients[16]. Some previous studies have shown clinical effects of combined exercise.

Combined aerobic and resistance exercises increased muscle strength, and decreased glycated hemoglobin and fasting glucose significantly in type 2 diabetes[17].In a study of male with coronary artery disease, exercise endurance increased and fat mass decreased significantly in a combined aerobic and strength training group compared with a group which received only aerobic training[18].Combined exercise training that mixes strengthening, aerobic, balance, and gait training has been studied. This type of training increased muscle strengthening and balance ability to prevent falls[19].

However, combined exercise training research is incomplete and needs more research for stroke patients[20]. Although there are many comparative studies which used single exercise groups, conventional treatment groups, and non- exercise control groups for stroke patients, few comparative studies of the effects of combined exercise have been performed, especially with stroke patients as subjects.

It is not clear whether or not the combination of exercise for muscle strength improvement and aerobic exercise, which are effective in gait training, is more effective than conventional rehabilitation exercise. Therefore the purpose of this study was to investigate the effects of combined exercise training with aerobic and functional strengthening exercises on balance of hemiplegic stroke patients.

OVERVIEW

Postural Control And Balance

Balance is disturbed following stroke with impairments in steadiness, symmetry, and dynamic stability common[21-23].Problems may exist when reacting to a destabilizing external force (reactive postural control) or during self-initiated movements (anticipatory postural control).Thus the patient may be unable to maintain balance in sitting or standing or to move in a weight bearing posture without loss of balance. Disruptions of central sensorimotor processing lead to an inability to adapt postural movements to changing tasks and environmental demands and impair motor learning[24].

Patients with stroke typically demonstrate asymmetry with most of the weight in sitting or standing (a finding characteristic of the elderly in general) [25].Delays in the onset of motor activity, abnormal timing and sequencing of muscle activity, and abnormal co-contraction result in disorganization of postural synergies. Corrective responses to perturbations or destabilizing forces are frequently inadequate and result in loss of balance and falls. Patients with hemiplegia typically fall in the direction of weakness[26,27].

Aerobic Exercise Training (Conditioning):

Aerobic exercise training, or conditioning, is augmentation of the energy utilization of the muscle by means of an exercise program[28-30]. The improvement of the muscle's ability to use energy is a direct result of increased levels of oxidative enzymes in the muscles, increased mitochondrial density and size, and an increased muscle fiber capillary supply. Training is dependent on exercise of sufficient intensity, duration, and frequency. Training produces cardiovascular and/or muscular adaptation and is reflected in an individual's endurance.

Training for a particular sport or event is dependent on the specificity principle[28-30]; that is, the individual improves in the exercise task used for training and may not improve in other tasks. For example, swimming may enhance one's performance in swimming events but may not improve one's performance in treadmill running. Adaptation results in increased efficiency of the cardiovascular system and the active muscles. Adaptation represents a variety of neurological, physical and biochemical changes in the cardiovascular and muscular systems Performance improves in that the same amount of work can be performed after training but at a lower physiological cost.

Functional Strength Training:

Functional strength training involves performing work against resistance in such a manner that the improvements in strength directly enhance the performance of movements so that an individual's activities of daily living are easier to perform. The development of muscle strength is an integral component of most rehabilitation or conditioning programs for individuals of all ages and all ability levels[31-33]. Strength training (strengthening exercise) is defined as a systematic procedure of a muscle or muscle group lifting, lowering, or controlling heavy loads (resistance) for a relatively low number of repetitions or over a short period of time[34-36].

The most common adaptation to heavy resistance exercise is an increase in the maximum force-producing capacity of muscle, that is, an increase in muscle strength, primarily as the result of neural adaptations and an increase in muscle fiber size[37-39].To be effective, a functional exercise program should include a number of different elements which can be adapted to an individual's needs or goals[40]. Based on functional tasks directed toward everyday life activities. Individualized a training program should be tailored to each individual. Any program must be specific to the goals of an individual, focusing on meaningful tasks. It must also be specific to the individual state of health, including presence or history of injury.

An assessment should be performed to help guide exercise selection and training load. It should include a variety of exercises that work on flexibility, core, balance, strength and power, focusing on multiple movement planes. Progressive training steadily

increases the difficulty of the task. Periodized is mainly by training with distributed practice and varying the tasks. Repeated frequently and use of real life object manipulation.

Conventional Exercises

The therapist focused on re-educating normal movement during functional activities that were meaningful to the patients. Training was composed of balance exercise, posture control exercise, and gait exercise.Keeping normal movement of the pelvis for balance and posture control was emphasized. The therapist judged that working on increasing anterior and posterior pelvic tilt would improve weight transfer and hip extension during gait, leading to improvements in selective distal control of the knee and the foot.

Trunk control and alignment can affect muscle tone, range of motion, and control of the limb. For the upper limbs, treatment was conducted focusing on movement of the scapula. For balance exercise, weight transfer exercise and reaching exercise were alternately performed on the affected side and the unaffected side in the sitting or standing position.

Bridging exercise was performed to strengthen the trunk muscles. Selective movement of each joint of the shoulder, elbow, knee, and ankle joint was performed to facilitate upper and lower limb movement. For gait exercise, training in weight transfer during gait was conducted by planting the unaffected side foot at the front and back of the body.

Gait training was divided between the stance phase and the swing phase, and exercises for each phase were performed. In addition, stair climbing practice and gait training for crossing obstacles were conducted. Patients did not do the same exercise every training day but suitable exercises were selected according to the goals of each patient and the therapist. The intensity of each exercise was decided by the therapist considering each patient's capacity for exercise[13].

NEED FOR THE STUDY

Weakness is an inability to generate normal levels of force and is a major impairment of motor function[41].The effects of muscle weakness on function are difficulty in eliciting and sustaining muscle activity, difficulty in generating force and lack of dexterity[42].Strength training after stroke can improve force-generating capacity, the efficiency of the weak muscles and functional motor performance.[8]

Although there are many comparative studies which used single exercise groups, conventional treatment groups, and non- exercise control groups for stroke patients, but only few comparative studies had seen in the effects of combined exercise have been performed, especially with hemiparetic stroke patients as subjects. It is not clear whether or not the combination of exercise for muscle strength improvement and aerobic exercise, which are effective in gait training, is more effective than conventional rehabilitation exercise.

Therefore the purpose of this study was to investigate the effects of combined exercise training with aerobic and functional strengthening exercises than the conventional exercises in balance of hemiparetic stroke patients.

AIM OF THE STUDY

To find the effectiveness of combined exercises which consists of aerobic training and functional strengthening exercise over conventional exercises which consists of balance,posture control exercise and gait training in improving balance in hemiparetic stroke patients.

OBJECTIVES OF THE STUDY

To find the effectiveness of combined exercises (functional strengthening exercise and aerobic) in improving the balance in hemiparetic stroke patients.

To find the effectiveness of conventional exercises (balance exercise,posture exercise and gait training) in improving balance in hemiparetic stroke patients.

To compare the effectiveness of combined exercise versus conventional exercises training in improving balance in hemiparetic stroke patients.

HYPOTHESIS

Hypothesis to test objective 1

A. Null Hypothesis :

There is no statistically significant difference between the pre test and post test balance scores in the hemiparetic stroke patients following in combined exercises group.

B. Research Hypothesis

There is a statistically significant difference between the pre test and post test balance scores in combined exercises group in the hemiparetic stroke patients.

Hypothesis to test objective 2

A. Null Hypothesis :

There is no statistically significant difference between the pre test and post test balance scores in the hemiparetic stroke patients following in conventional exercise group.

B.Research Hypothesis

There is statistically significant difference between the pre test and post test balance scores in conventional exercises group in the hemiparetic stroke patients.

Hypothesis to test objective 3

A. Null Hypothesis :

There is no statistically significant difference between the mean balance scores in the hemiparetic stroke patients of combined exercises group (group 1) and conventional exercises group (group 2).

B.Research Hypothesis

There is a statistically significant difference between the mean balance scores of hemiparetic patients combined exercises group (group 1)and conventional exercises group (group 2) .

REVIEW OF LITERATURE

Weakness in stroke:

Zackowski KM,Dromerick AW,Saharmann SA,Thach WT,Bastian AJ (2004) concluded that the deficit in joint individuation reflects a fundamental motor control problem that largely explains some aspects of voluntary reaching deficit of hemiparetic subjects when they investigated whether the inability to individuate joint movements associated with deficits in functional reaching.

Gemperline JJ,Allen S,Walk D,Rymer WZ (1995) found the failure to increase motor unit discharge rate during voluntary force increases in paretic muscle of six hemiparetic patients arm.They also stated that reduction of discharge affect the efficiency of muscle contraction and also could lead to,in turn to increased effort,to fatigue,and ultimately to a sense of weakness for voluntary force generation.

Bourbonnais D,Vanden Noven S(1989) discussed clinical and experimental results and concluded that the important role that alterations in the physiology of motor units,notably changes in firing rates and muscle fiber atrophy,play in the manifestation of muscle weakness than spasticity.

Rosenfalck A,Andreassen S(1980) reported that patients with spasticity were unable to maintain a constant force of the anterior tibial muscle.The force at maximal effort was reduced to less than 40% of normal,partly because motor units fired at a reduced rate even at higher levels of contraction.

Fidel Lopez Espuela R N,Juan Diego Pedrera-Zamorana (2018) concluded that functional status 6 months after stroke was influenced by age,sex,stroke severity,type of stroke,baseline status,mood and social risk in the longitudinal study of functional status and disability in patients after acute stroke.

Aerobic

Teixeira-Salmela LF,Nadeau S,McBrideI,Olney SJ(2001)evaluated that the impact of a combined program of muscle strengthening and physical conditioning on gait performance in subjects with chronic stroke subjects,using a single group pre – post test design of thirteen subjects,Their results proved significant difference in lower limb motor activity through gait analysis which revealed that improvement in walking patterns due to 10 week training program which consisted of warm-up,aerobic exercises,lower extremity muscle stremgthening and cool-down.

Kathleen Potempa, Martita Lopez, Lynne T. Braun, J.Peter Szidon, Louis Fogg, Tyler Tincknell(1995) found that the hemiparetic stroke patients may improve their aerobic capacity and sensorimotor improvement is related to the improvement with training in their study of Physiological outcomes of aerobic exercise training in hemiparetic stroke patients.

R.F.Macko,C.A Desouza,L.D Tretter,K.H Silver,P.A Anderson,Naomi Tomoyasu,P.Gorman,D.R Dengel(1997) had identified that the task oriented aerobic exercise may improve functional mobility and the cardiovascular fitness in this study of Treadmill aerobic exercise training reduces the energy expenditure and cardiovascular demands of hemiparetic gait in chronic stroke patients.

Marco Y.C.Pang, Sarah A. Charlesworth, Ricky W.K.Lau, Raymond C.K. Chung(2013) concluded that there is strong evidence of that aerobic exercise conducted is beneficial for enhancing aerobic fitness,walking speed and walking endurance in people who have mild to moderate stroke in the Evidence-based exercise prescription using aerobic exercise to improve health outcomes and quality of life in stroke.

Sung-Jin Kim,Hwi-young cho,You Lim Kim and Suk-min Lee(2015) Concluded that Stationary cycling,which requires less balance capability,has been used for training patients with or without nervous system disorders who have difficulty in maintaining balance and independent gait.Cycling and walking share similar locomotor patterns of reciprocal flexion and extension movements and alternating muscle activation of antagonists.Cycling can improve functional mobility and acts as a pseudo walking task oriented exercise.Besides

improving muscle strength,cycling also facilitates muscle control of the lower limbs,which may allow putting more weight on the affected leg while standing in the studyon the effects of stationary cycling exercise on the balance and gait abilities of chronic stroke patients

Conventional Physiotherapy:

Ahamet Inanir,Sevil O Kon,Behget Filiz,Emre Kuyucu(2013)had stated that this approach is effective and useful in restoring atatic and dynamic balance as well as in obtaining an effective improvement in the treatment of patients with stroke through conventional treatment in the effectiveness of conventional rehabilitation therapy on postural stability and clinic in stroke patients with hemiplegia.

Venkadesan R(2009) has stated that there is combined effect of treadmill and conventional gait training in post stroke patients had better walking abilities than conventional training.Hence combined gait training strategy is essential in gait rehabilitation in the comparative study of conventional gait training versus conventional and treadmill gait training in subacute stroke patients.

Berg Balance Scale:

Downs S, Marquez J, Chiarelli P (2013): The Berg Balance Scale has acceptable reliability, although it might not detect modest, clinically important changes in balance in individual subjects. The review was only able to comment on the absolute reliability of the Berg Balance Scale among people with moderately poor to normal balance in the systematic review regarding the Berg Balance Scale has high intra- and inter-rater reliability but absolute reliability varies across the scale.

Stephen Downs(2015) The Berg Balance Scale has a high relative reliability with inter-rater reliability estimated at 0.97 (95% CI 0.96 to 0.98) and intra-rater reliability estimated at 0.98 (95% CI 0.97 to 0.99). The absolute reliability of the Berg Balance Scale varies across the scale, with minimal detectable change with 95% confidence varying between 2.8/56 and 6.6/56. The absolute reliability is stronger at the high end and weaker towards the middle of the scale.

SHIGERU USUDA,KAZUFUMI ARAYA, KENICHI UMEHARA, MEGUMI ENDO, TOMOYO SHIMIZU, FUMIO ENDOL(2015) The BBS is a useful tool not only in hospital stroke rehabilitation but also community rehabilitation. Good validity, high sensitivity and good simplicity of the BBS will facilitate clinical or research use. The BBS will be measured to predict falls, functional goals, the length of stay in hospital, judge the effect of treatment and analyze the model of disability in stroke rehabilitation for the Validity of Functional Balance Scale in Stroke Inpatients.

Timed Up and Go Test:

Chan PP, Si Tou JI, Tse MM, Ng SS(2017) The TUG motor is a reliable, valid, and easy-to-administer clinical tool for assessing advanced functional mobility after a stroke.in the study Reliability and Validity of the Timed Up and Go Test With a Motor Task in People With Chronic Stroke.

Katrine Lyders Johansen,Rikke Derby Stistrup, Camilla Skibdal Schjøtt, Jacqueline Madsen, and Anders Vinther,Sonia Brucki(2016) Excellent reliability was observed for the timed 'Up & Go' test and the '30second Chair-Stand' test in hospitalised stroke patients. The thresholds to detect a real change in performance were 18.7% for the timed 'Up & Go' test and 2.0 repetitions for the '30second Chair-Stand' in groups of patients and 26.5% and 3 repetitions in individual patients, respectively in the Absolute and Relative Reliability of the Timed 'Up & Go' Test and '30second Chair-Stand' Test in Hospitalised Patients with Stroke

Peggy P. Chan,Joyce I. Si Tou,Mimi M. Tse,Shamay S. Ng(2017) The TUG motor completion times and number of steps demonstrated excellent intra-rater, interrater, and test-retest reliabilities. The TUG motor times correlated significantly with the Fugl-Meyer Assessment for the Lower Extremities and Berg Balance Scale scores, with hip abductor, knee flexor, ankle dorsiflexor and plantar flexor strength on the paretic side, with 5-times sit-to-stand test times, and with times on the conventional timed Up and Go test. The TUG motor is a reliable, valid, and easy-to-administer clinical tool for assessing advanced functional mobility after a stroke in Reliability and Validity of the Timed Up and Go Test With a Motor Task in People With Chronic Stroke.

MATERIALS AND METHODLOGY

RESEARCH DESIGN

A Pretest-Posttest experimental study consisting of 30 stroke patients were undertaken to investigate the balance of the hemiparetic stroke patients. There are two experimental groups.

SELECTION CRITERIA :

Inclusion Criteria :

- Patients with stroke involving in lower extremity
- Patient within 6 months of post stroke period
- Both sexes
- Age group between 35-50 years
- Patient who can stand independently without any assistive devices at least for a minute.

Exclusion Criteria

- Haemodynamically unstable
- Patient could not perform functional exercise due to arthritis
- Low back pain, with radiating pain and numbness over legs
- Cardiovascular and Respiratory conditions impairing aerobic training
- Patient who have uncontrolled hypertension
- Patients who could not follow instructions due to low perceptive abilities, cognitive disorder
- Hearing impairment

SAMPLE SIZE AND SAMPLING

Purposive sampling of thirty samples was adopted in this study. A group of 30 subjects who had satisfied the inclusion criteria and exclusion criteria were selected and they were purposively divided into two groups.

Group 1- received combined exercises with aerobics and functional strengthening exercise

Group 2- received conventional exercises.

Setting of Study:

Narayana Health,Multi speciality Hospital,Bangalore-99.

Duration of The Study :

It was an experimental study with the duration of 4 weeks of treatment per subject .

OUTCOME MEASURES

- Timed up and go test
- Berg Balance Scale

MATERIALS USED

- Inch tape
- Stop watch
- Object to pick up off the floor
- Step stool
- Pulse oximetry
- Standard Chair

PROCEDURE

The subjects were informed about the purpose, procedure, and effects of the study. The patients were assessed to ensure about the inclusion and exclusion criteria. Then the informed consent will be obtained. The selected subjects were divided into two equal groups by simple

purposive sampling method. The selected sample will complete a data proforma. The subjects of group A and Group B were considered as experimental group.

Pre Test :

The subjects were assessed on the first day before the intervention with two standard outcome measures. The subject's static balance of lower extremity were measured by Berg Balance Scale[41-45] which has 14 items for balance components .Then the dynamic balance performance is assessed by using Timed up and go test[46-48] .The measurements are recorded.

Intervention :

Intervention was implemented according to the group to which the subjects belong. The subjects of experimental groups received only the experimental exercises. The subjects belong to group A were trained with combined exercises with functional strengthening exercises and aerobics. The subjects belong to the group B were trained with conventional exercises. The exercises administered to the patients were as follows.

All the subjects have to do the 6 specific sub- category exercises for 15 repetitions per set for the total of three sets per day.

Combined : 5 min of breathing exercises and stretching are warming up exercises

30 min of functional strengthening exercises

Aerobics exercise initial 5 minites was an adaptation period,in next 10 minutes velocity should be increased.

Conventional:The group which did conventional exercise. This conventional training consists of

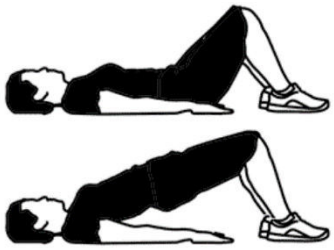
a) balance exercise
b) posture control exercise
c) gait exercise

Each group exercised for 60 minutes per day, 5 times a week.

Exercises For Experimental Group 1:

Functional Strengthening Exercise

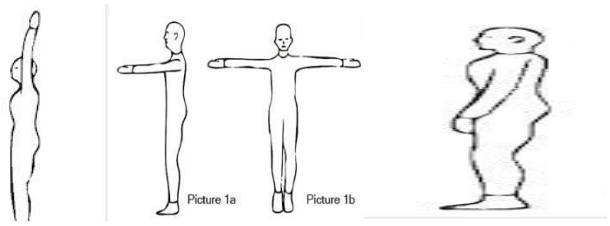
1. BRIDING EXERCISE : Bridge exercise is lifting pelvis using the legs, from bending hips and knees with supine.



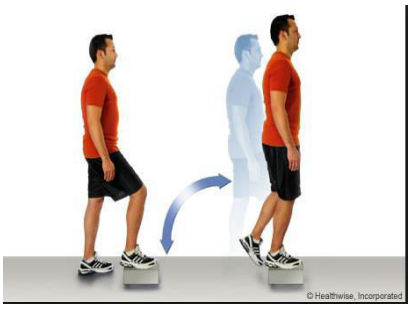
2. LIFTING TOES AND ANKLES: Lifting toes and ankles exercise is dorsiflexion and plantar flexion of the hemiplegic leg in the sitting position.

3. SITTING AND STANDING :Sitting and standing is standing from sitting and sitting again until the hip touches chair.

4. STRETCHING THE ARMS :Stretching out the arms while standing is stretching out the arms upward, downward, right-side, left-side, and diagonally.



5. STEP EXERCISE: Step exercise is shifting of weight bearing to a leg on a step. The hemiplegic leg and non-hemiplegic leg are placed in turn on the step, and the location of step alternates from the front to one side of the subject.



6. STAIRS EXERCISE:Stairs exercise is walking up stairs with the hemiplegic leg supporting the body weight and walking down stairs with the non-hemiplegic leg support body weight.

Aerobics:

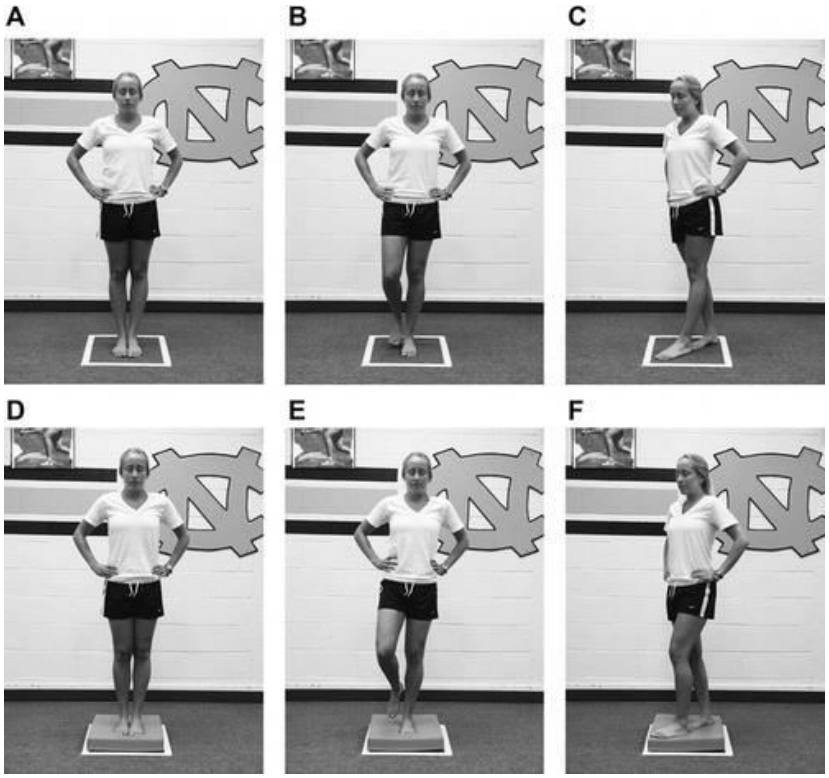
- The second exercise for the combined exercise training group was aerobic exercise.
- Treadmill walking and riding a bicycle were conducted for fifteen minutes each.
- Treadmill walking started at 0.5 m/s and the initial 5 minutes was on adaption period.
- In the next 10 minutes walking velocity increased or walking was done with less support from eht hand-rail[22].
- A stationary bicycle was used for the bicycle riding exercise.
- At the beginning a patient started with a velocity which he/ she could feel comfortable with.
- As time went by the velocity was increased. The intensity of the two aerobic exercises was determined by checking the heat rate.
- Heart rate reserve was calculated using age and maximum heart rate. Resting heart rate was evaluated at the same time in the morning and re- evaluated on the first day of each week.
- The intensity of exercise was adjusted following a change in resting heart rate[14].

Exercises For Experimental Group 2:

Conventional Exercises

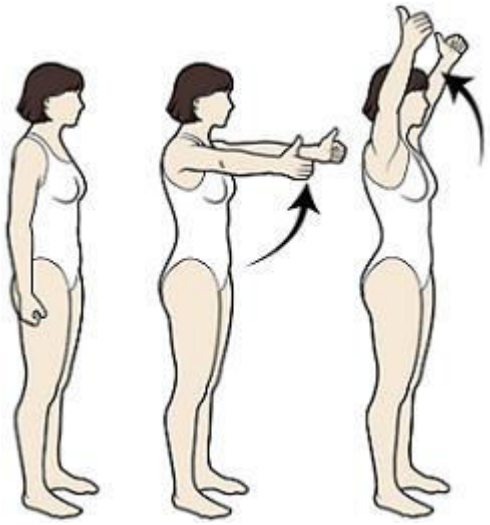
POSTURAL EXERCISE

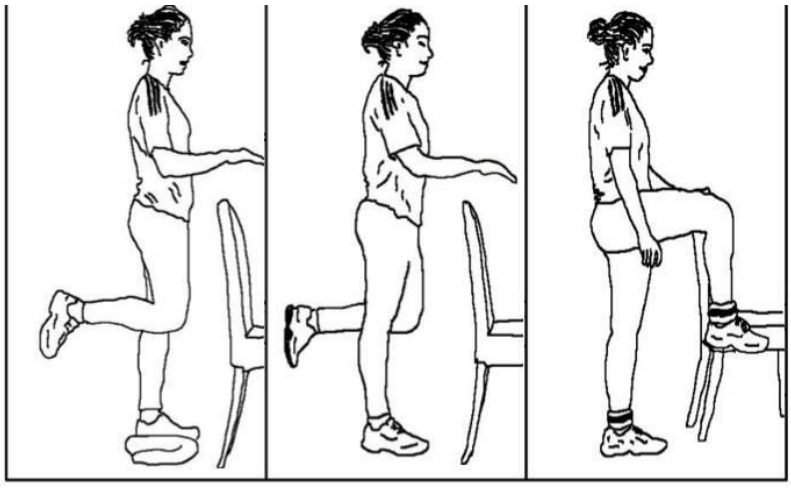
- Keeping normal movement of the pelvis for balance and posture control was emphasized.
- The therapist judged that working on increasing anterior and posterior pelvic tilt would improve weight transfer and hip extension during gait, leading to improvements in selective distal control of the knee and the foot.
- Trunk control and alignment can affect muscle tone, range of motion, and control of the limb.
- For the upper limbs, treatment was conducted focusing on movement of the scapular.

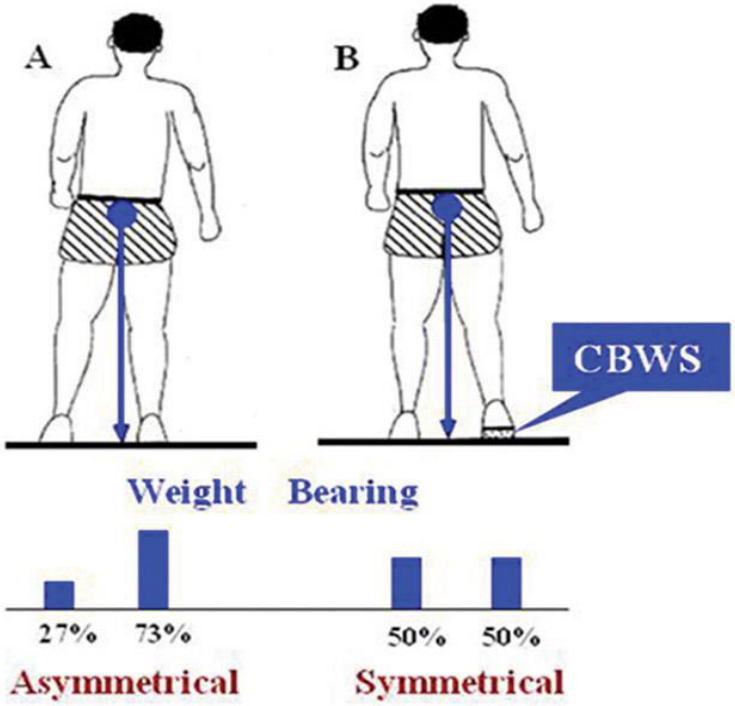


BALANCE EXERCISE

- For balance exercise, weight transfer exercise and reaching exercise were alternately performed on the affected side and the unaffected side in the sitting or standing position.
- Bridging exercise was performed to strengthen the trunk muscles. Selective movement of each joint of the shoulder, elbow, knee, and ankle joint was performed to facilitate upper and lower limb movement.







GAIT EXERCISE

- For gait exercise, training in weight transfer during gait was conducted by planting the unaffected side foot at the front and back of the body.
- Gait training was divided between the stance phase and the swing phase, and exercises for each phase were performed. In addition, stair climbing practice and gait training for crossing obstacles were conducted.
- Patients did not do the same exercise every training day but suitable exercises were selected according to the goals of each patient and the therapist.

POST TEST

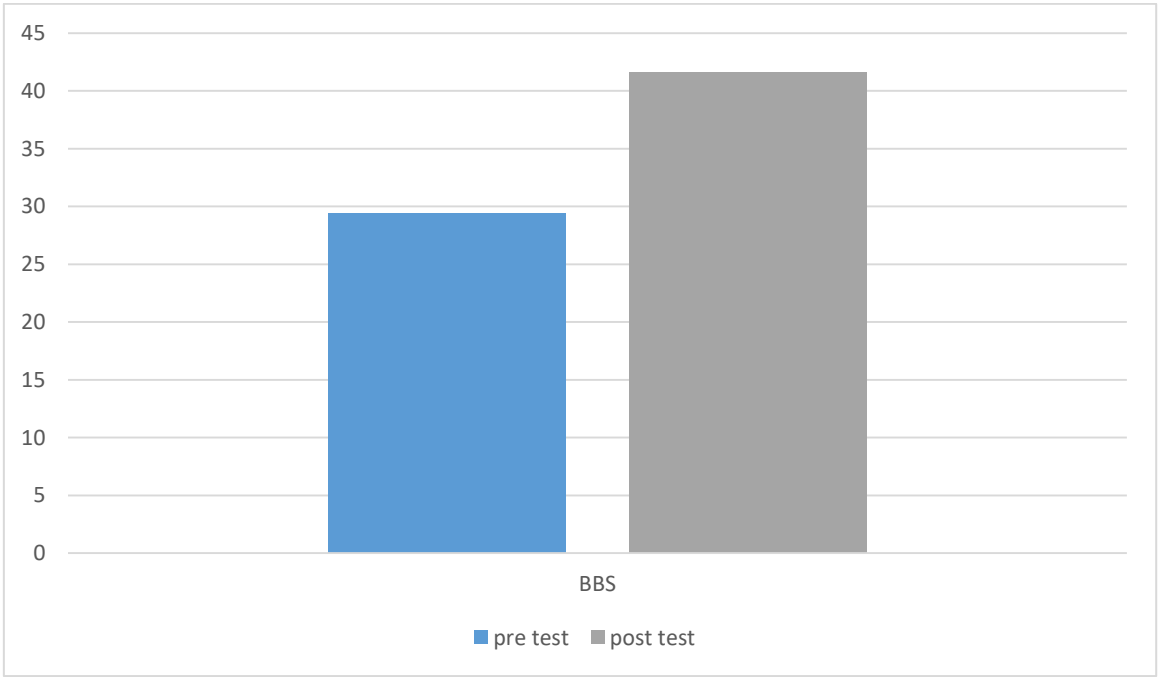
At the end of the fourth week treatment session of the study,the patient's functional performance both static and dynamic balance was assessed through the same two outcome measures in the hemiparetic stroke patients.

DATA PRESENTATION AND ANALYSIS

Statistical Results For Berg Balance Scale Group 1

s.no	BBS pre test mean	BBS post test mean	t value
1	29.4	41.6	12.24

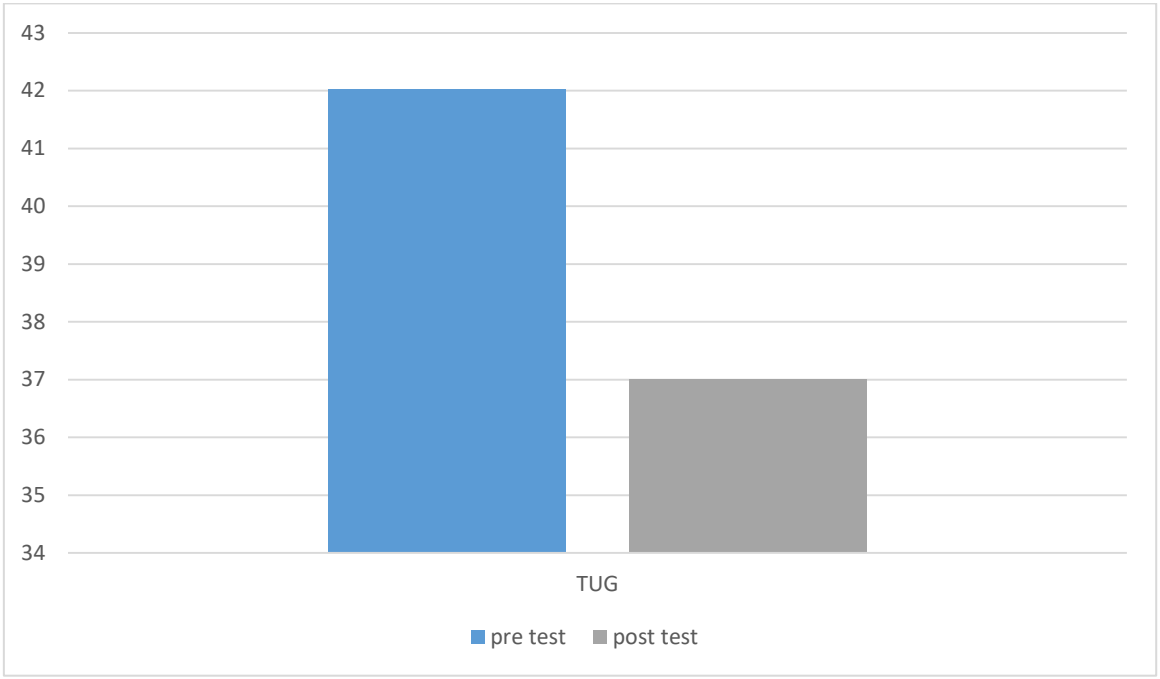
Graphical Representation of Pre Test and Post Test Berg Balance Scale Scores of Group 1



Statistical Results For Timed Up and Go Test Group 1

s.no	TUG pre test mean	TUG Post test mean	t value
1	42.02	37.00	7.76

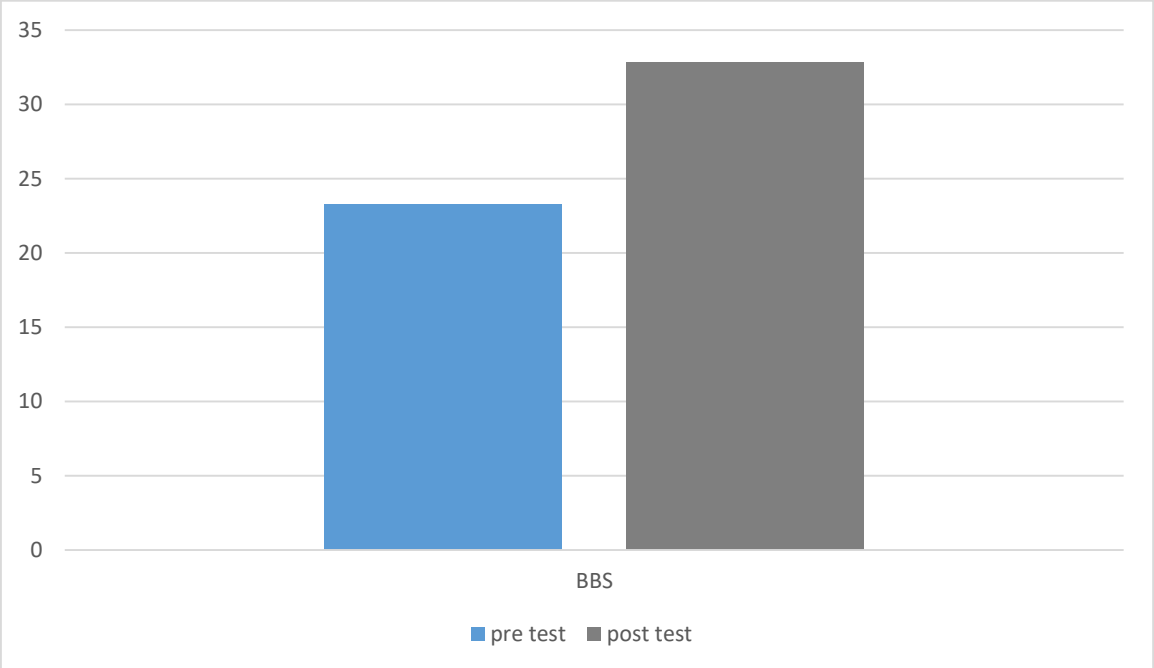
Graphical Representation of Pre Test and Post Test Timed Up and Go Scores of Group 1



Statistical results for Berg Balance Scale group 2

s.no	BBS pre test mean	BBS post test mean	t value
1	23.26	32.8	13.56

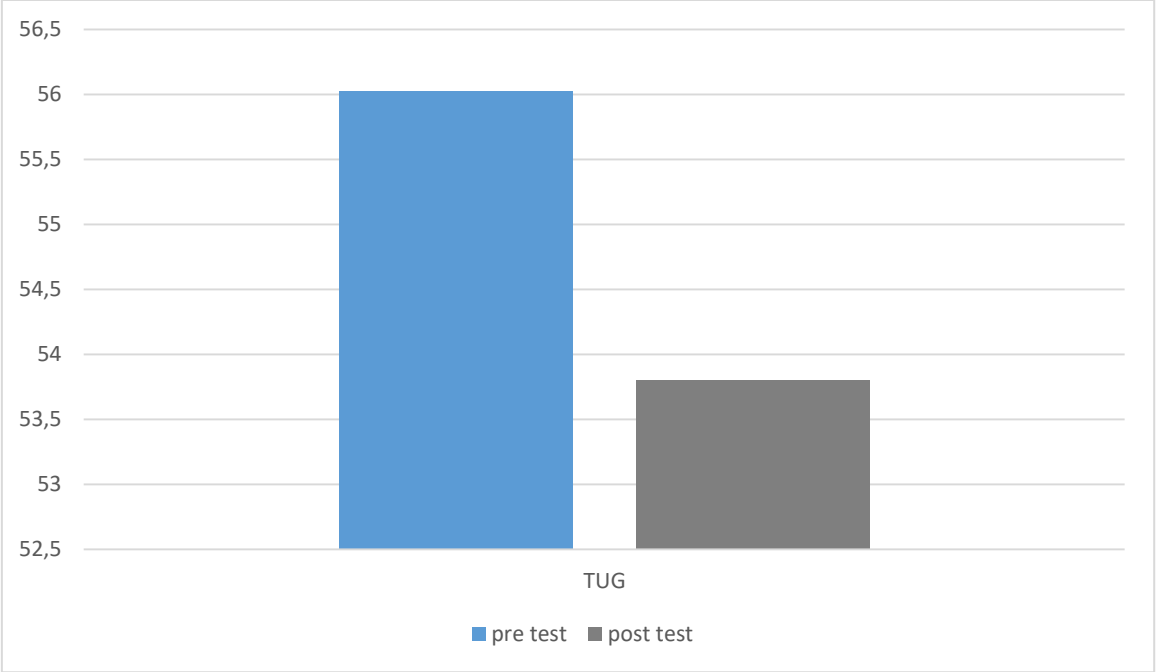
Graphical Representation of Pre Test and Post Test Berg Balance Scale Scores of Group 2



Statistical Results For Timed Up and Go Test Group 2

s.no	TUG pre test mean	TUG post test mean	t value
1	56.03	53.80	10.16

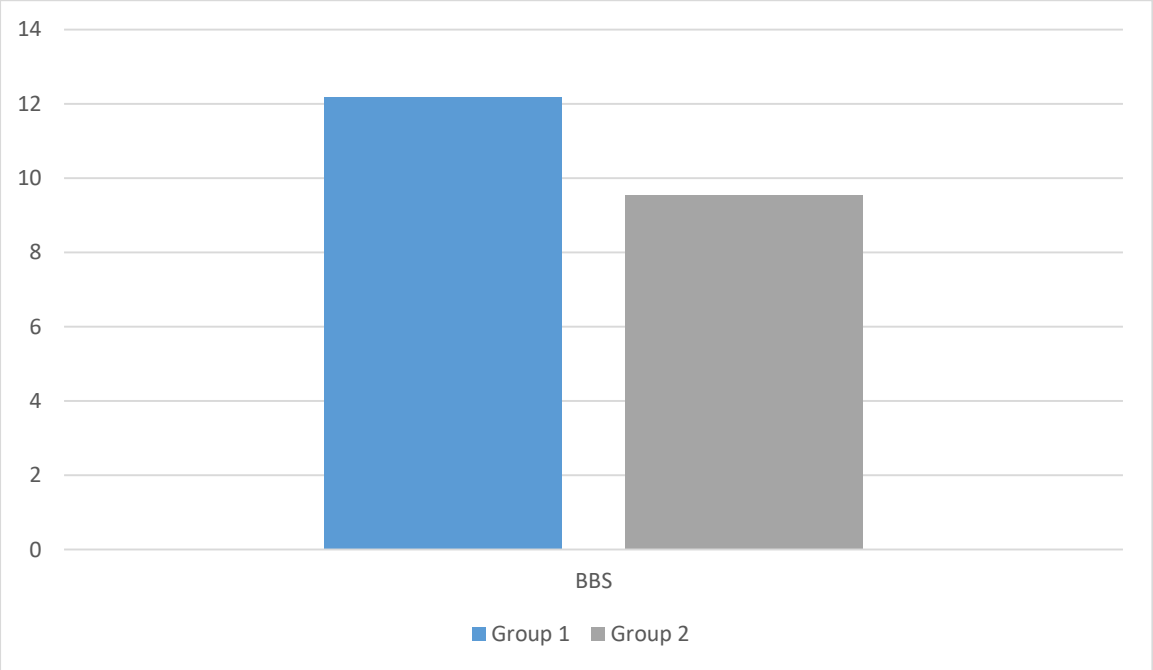
Graphical Representation of Pre Test and Post Test Timed Up and Go Scores of Group 2



Comparison Of Mean Berg Balance Scale Of Group 1 and Group 2

s.no	mean difference of Group 1	mean difference of Group 2	t value
1	12.2	9.73	2.119

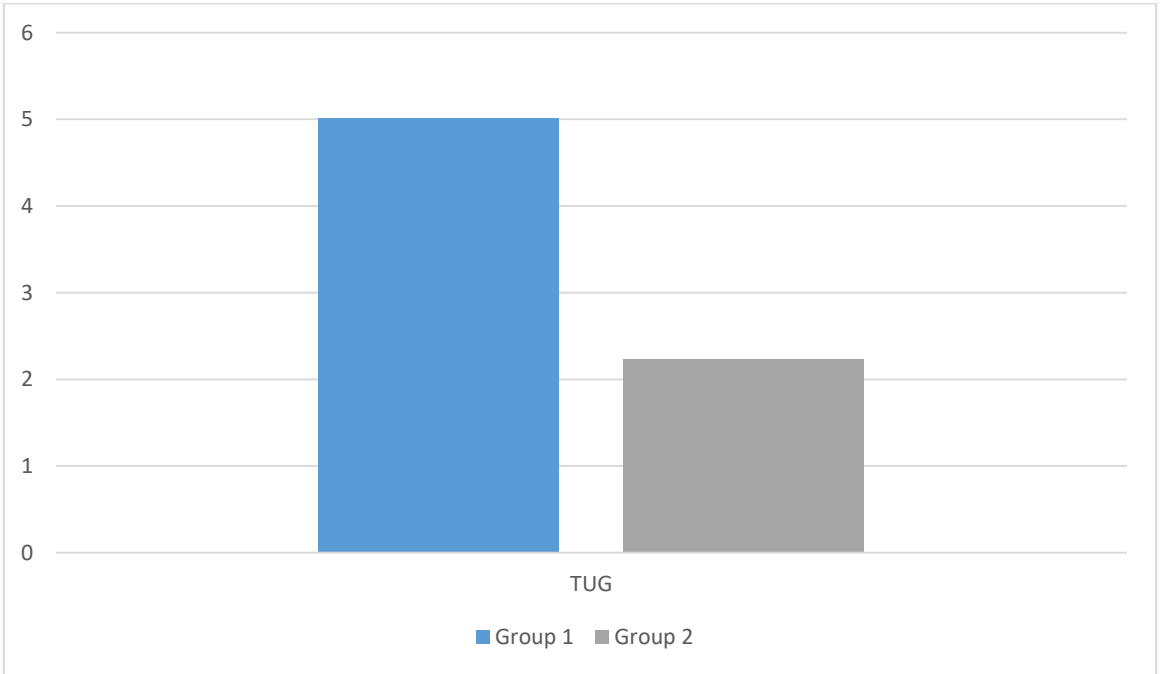
Graphical Representation Mean Berg Balance Scale Scores of Group 1 and Group 2



Comparison Of Mean Timed Up and Go Of Group 1 and Group 2

s.no	mean difference of Group 1	mean difference of Group 2	t value
1	5.012	2.228	4.084

Graphical Representation Mean Timed Up and Go Scores of Group 1 and Group 2



RESULTS AND DISCUSSIONS

Results:

RESULT FOR OBJECTIVE 1:

As the calculated value is greater than the t table value. Null hypothesis 1 (H_o1) is rejected and research hypothesis 1 ($H_1 1$) is accepted

RESULT FOR OBJECTIVE 2:

As the calculated value is greater than the t table value. Null hypothesis 2 ($H_0 2$) is rejected and research hypothesis 2 ($H_1 2$)is accepted

RESULT FOR OBJECTIVE 3:

As the calculated value is greater than the t table value. Null hypothesis 1 ($H_0 3$)is rejected and research hypothesis 3 ($H_1 3$)is accepted

Discussions:

In this study ,there are improvement in the conventional exercise group as well as in the combined exercise group also in improving balance of the hemiparetic stroke patients. But, there is considerable more improvement in patients who received the combined group of exercise than the conventional group of exercise in hemiparetic stroke patients. In a study of male with coronary artery disease, exercise endurance increased and fat mass decreased significantly in a combined aerobic and strength training group compared with a group which received only aerobic training[18].The improvement of the muscle's ability to use energy is a direct result of increased levels of oxidative enzymes in the muscles, increased mitochondrial density and size, and an increased muscle fiber capillary supply.

Combined exercise training that mixes strengthening, aerobic, balance, and gait training has been studied. This type of training increased muscle strengthening and balance ability to prevent falls[19]Also cycling training with body weight support, as an automatically symmetric exercise, activated the paretic limb muscles, and increased the ability of motion of each side. These interventions improved the balance ability of stroke patients[14].

The ability to control body weight on support both the paretic limb and non-paretic limb is equally important in ADL and it is a goal of rehabilitation training[3]. The result of this study suggests that combined exercise training can be clinically prescribed for stroke patients to reduce the risk of falls and lead to independent ADL.

SUMMARY AND CONCLUSIONS

Summary

In this study,totally 30 subjects of the hemiparetic stroke patients are taken into two experimental groups equally into Combined exercises group (aerobic and functional strengthening exercises) **group 1** and conventional exercises group (balance exercises,posture exercises and gait training)**group 2** in improving the static and dynamic balance by using the Berg Balance Scale (BBS) and Timed Up and Go test (TUG) as the outcome measuring scale.Based on the results found in this study there are improvements in both the combined exercises,group 1 and conventional exercises,group 2,But,there are significant better improvement in the combined exercises, group 1 than the conventional exercises,group 2.So,the results found are published.

Conclusion

Based on this study combined exercises given to group 1 has shown the improvement in both the static and dynamic balance scores in the hemiparetic stroke patients.

Based on this study conventional exercises given to group 2 has shown the improvement in both the static and dynamic balance scores in the hemiparetic stroke patients.

Based on this study combined exercise of group 1 had shown the marked improvement in both the static and dynamic balance than the conventional exercises of group 2 in the hemiparetic stroke patients.This suggests that combined exercise training can be prescribed for stroke patients to reduce their risk of falls and lead to independent ADL.

LIMITATIONS AND RECOMMENDATIONS

Limitations:

- Larger sample is required to generalise the study results
- Perception of intensity of the exercises varied widely among the study population
- The long lasting beneficial effects of the exercises are not taken into account in terms of outcome
- Only hemiparetic patients are subjected to the study
- The outcome measures are subjected to only less duration

Recommendations:

- The subjects of the hemiplegia also be subjected for the experiment for the comparative study of combined exercise group and conventional exercise group.
- A comparative study with conventional treadmill training,conventional exercise and bicycling training for hemiparetic patients
- The improvement by using the treadmill and functional stregthening exercise as combined exercise group in hemiparetic should also be experimented.
- The improvement by using the stationary bicycling and functional stregthening exercise as combined exercise group in hemiparetic should also be experimented.
- The progression of the subjects should also be measured in the scale for ADL activities.

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ANNEXURE - I

TITLE:

"Effects of Combined Exercise Training on Balance of Hemiparetic Stroke Patients"

INVESTIGATOR : 271620161

PURPOSE OF RESEARCH:

I ..... have been informed that this study intend to find the effectiveness of conventional exercise and combined functional strengthening exercise and aerobics for the improvement of lower limb activity in stroke patients.The exercises what I am going to receive are accepatable way of treatment.This study will help health professionals to know about the effective way of treating the stroke patients with lower limb weakness.

PROCEDURE :

I understand that there are two groups [Experimental group – 1,Experimental group – 2].I am also aware that I will be randomly allotted to any one group. If I am randomized to group 1, I will have to undergo combined functional strengthening exercises and aerobics exercise. If I am randomized to group 2, I will have to undergo conventional exercises. The exercise which I receive would be according to my tolerance and fatiguability and enough rest and safety will be provided. I am aware that I have to follow the Physiotherapist's instructions as has been told to me. As the follow up I have to practise the exercises taught by the Physiotherapist regularly without fail. I may withdraw from the study if any discomfort is faced during the exercises.

RISK AND COMFORT:

I understand that there are risks associated with the patients prone to fatiguability and adverse effect of over activity and I also know the tolerable level and I will inform any discomfort experienced during exercises and the investigator will accompany me and take care of me during exercises.

BENEFITS:

The recorded scores obtained by the patient's performance will be helpful to know the effectiveness of the experimental exercises in improving the lower limb motor activity and balance stroke patients.

CONFIDENTIALITY:

I understand that medical information produced by this study will be confidential.If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other literatures such as photographs and audio or video tapes will be used only with prior information.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may withdraw consent and discontinue participation at any time. I also understand that he may terminate my participation in the study at any time after he has explained me the reasons for doing so.

INJURY STATEMENT:

I understand that the exercises which I am going to perform are most unlikely to cause any injury or further deteriorate my condition if performed under the guidance of my therapist. In such cases medical attention will be provided, but no further compensation will be provided. I understand my agreement to participate in this study and I am not waiving any of my legal and ethical rights.

I confirm that the investigator have explained me the purpose of the study, the study procedure and the possible risks and benefits that I may experience. I have read and fully understood this study and voluntarily provide consent to be a subject in this study.

NAME OF THE SUBJECT: DATE:

SIGNATURE:

NAME OF THE WITNESS: DATE:

SIGNATURE:

I have explained to Mr/Mrs.....the purpose of the research, the procedure required and the possible risks and benefits, to the best of my ability.

NAME OF THE INVESTIGATOR: DATE:

SIGNATURE:

ANNEXURE – II

NEUROLOGICAL PHYSIOTHERAPY EVALUATION FORM

I. Subjective Assessment

Name: Age: Gender: M/F IP/OP

Occupation: Handedness: R/L Referred by:

Address:

Chief Complaints:

Past Medical History:

Personal History:

Family History: Socioeconomic

History: Symptoms History:

Side:

Onset:

Type:

Site:

Aggravating Factors:

Duration:

Severity:

Relieving Factors:

Vital Signs:

Temperature:

Blood Pressure:

Respiratory Rate:

Heart Rate:

II. Objective Examination

a) ON OBSERVATION:

Attitude of limbs:

Built:

Posture:

Gait:

Pattern of Movement:

Mode of Ventilation:

Type/ Pattern of Respiration:

Oedema:

Muscle Wasting:

Pressure Sores:

Deformity:

Wounds:

External Appliances:

b) ON PALPATION

Warmth:

Tenderness:

Tone: Swelling:

c) ON EXAMINATION

HIGHER MENTAL FUNCTIONS

Level of Consciousness:

Orientation:

Person:

Place:

Time:

Memory:

Immediate:

Recent:

Remote:

Verbal:

Visual:

Communication:

Cognition:

Fund of Knowledge:

Calculation:

Proverb Interpretation:

Attention: Emotional Status:

Perception:

Body Scheme/ Body Imaging:

Agnosias/ Apraxias: Special

Senses:

Cranial Nerves:

Nerves	Comments	Nerves	Comments
I - Olfactory		VII - Facial	
II - Optic		VIII - VestibuloCochlear	
III - Oculomotor		IX - Glossopharyngeal	
IV - Trochlear		X - Vagus	
V - Trigeminal		XI - Accessory	
VI - Abducent		XII - Hypoglossal	

SENSORY SYSTEM:

Location	Upper Extremity		Lower Extremity		Trunk		Comments
Sensation	Rt.	Lt	Rt.	Lt.	Rt.	Lt.	
Superficial							
Pain							
Temperature							
Touch							
Pressure							
Deep							
Mov. Sense							
Pos. Sense							
Vibration							
Cortical							
Tactile Localization							
2 pt. discrimination							
Stereognosis							
Barognosis							
Graphesthesia							
Texture Recognition							
Double Simultaneous Stimulation							

MOTOR SYSTEM:

Muscle Girth:

Area	Rt.(cm.)	Lt.(cm.)
Arm		
Forearm		
Thigh		
Calf		

Voluntary Control:

Side	Rt.	Lt.
Upper Limb		
Lower Limb		

Range of Motion:

Joint	Side	Movement	Limitation	Limiting factor
Shoulder				
Elbow				
Forearm				
Wrist				
Hand & Fingers				
Hip				
Knee				
Ankle & foot				
Cervical Spine				
Thoracic Spine				
Lumbar Spine				

Limb Length

Side	Rt.(cm.)	Lt.(cm.)
True		
Apparent		

Muscle Tone:

Muscles	Rt.	Lt.
Shoulder		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Elbow		
Flexors		
Extensors		
Forearm		
Pronators		
Supinators		
Wrist		
Flexors		
Extensors		
Radial Deviators		
Ulnar Deviators		
Hand		
Intrinsics		
Extrinsics		

Muscles	Rt.	Lt.
Hip		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Knee		
Flexors		
Extensors		
Ankle		
Dorsiflexors		
Plantarflexors		
Foot		
Invertors		
Evertors		
Intrinsics		
Extrinsics		

Muscle Power:

Muscles	Rt.	Lt.
Shoulder		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Elbow		
Flexors		
Extensors		
Forearm		
Pronators		
Supinators		
Wrist		
Flexors		
Extensors		
Radial Deviators		
Ulnar Deviators		
Hand		
Intrinsics		
Extrinsics		

Muscles	Rt.	Lt.
Hip		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Knee		
Flexors		
Extensors		
Ankle		
Dorsiflexors		
Plantarflexors		
Foot		
Invertors		
Evertors		
Intrinsics		
Extrinsics		

Trunk Flexors		
Trunk Extensors		
Trunk Side Flexors		
Trunk Rotators		

Reflexes:

	Reflex	Left	Right
Superficial	Abdominal		
	Plantar		
Deep	Biceps		
	Brachioradialis		
	Triceps		
	Knee		
	Ankle		

Pathological:

Coordination:

Non Equilibrium Test	Rt.	Lt.
Finger to nose		
Finger opposition		
Mass Grasp		
Pronation / Supination		
Rebound test		
Tapping (Hand)		
Tapping (Foot)		
Heel to knee		
Drawing a circle (Hand)		
Drawing a Circle(Foot)		

Equilibrium test	Grade
Standing : Normal Posture	
Standing : Normal Posture with vision	
Standing : Feet together	
Standing on one foot	
Standing : Lateral trunk flexion	
Tandem walking	
Walk: Sideways	
Walk: Backward	
Walk in a circle	
Walk on heels	
Walk on toes	

Involuntary Movements:

Balance:

- Sitting:
- Standing:
- Balance Reactions:

Posture:

- Lying:
- Sitting:
- Standing:

Gait

- Step Length:
- Stride Length:
- Base width:
- Cadence:
- Biomechanical Deviations:

Hand Functions:

- Reaching:
- Grasping:
- Releasing:

Assisstive Devices:

III. Systems Review:

INTEGUMENTARY SYSTEM:

Skin Status:

Pressure Sores:

RESPIRATORY SYSTEM:

RS Status:

Secretions:

Pattern of breathing:

Chest wall/Thoracic spine deformity:

CARDIOVASCULAR SYSTEM

CVS Status:

Deep Vein Thrombosis:

MUSCULOSKELETAL SYSTEM

Contractures:

Subluxations:

Joint mobility:

Other pathology: BLADDER

& BOWEL FUNCTIONS

Incontinence:

GASTROINTESTINAL SYSTEM

Status:

AUTONOMIC SYSTEM

Vasomotor:

Pseudomotor:

Trophic Changes:

Postural Hypotension:

Reflex Sympathetic Dystrophy:

IV. Functional Assessment: (The Functional Independence Measure)

Evaluation 1: Selfcare

Item 1. Food

Item 2. Care of appearance

Item 3. Hygiene

Item 4. Dressing upper body

Item 5. Dressing lower body

Evaluation 2: Sphincter control

Item 6. Control of bladder

Item 7. Control of bowel movements

Evaluation 3: Mobility

Item 8. Bed, chair, wheel chair

Item 9. To go to the toilets

Item 10. Bath-tub, shower

Evaluation 4: Locomotion

Item 11. Go, wheel chair

Item 12. Staircases Evaluation

5: Communication

Item 13. Auditive comprehension

Item 14. Verbal expression Evaluation 6:

Social adjustment/cooperation

Item 15. Capacity to interact and to socially communicate

Item 16. Resolution of the problems

Item 17. Memory

Investigation Findings:

Problem List:

Sl.	Impairment	Functional Limitation

Functional Diagnosis:

V. Management

Goals:

Short term:

Long term:

Treatment:

ANNEXURE III

OUTCOME MEASURES

Berg Balance Tests And Rating Scale

Patient Name

_____

Date _____

Location _____

Rater _____

ITEM DESCRIPTION SCORE (0-4)

- Sitting to standing _____
- Standing unsupported _____
- Sitting unsupported _____
- Standing to sitting _____
- Transfers _____
- Standing with eyes closed _____
- Standing with feet together _____
- Reaching forward with outstretched arm _____
- Retrieving objectfrom floor _____
- Turning to look behind _____
- Turning 360 degrees _____
- Placing alternate foot on stool _____
- Standing with one foot in front _____
- Standing on one foot _____

  TOTAL _____

GENERAL INSTRUCTIONS

- Please demonstrate each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.
- In most items, the subject is asked to maintain a given position for a specific time.
- Progressively more points are deducted if the time or distance requirements are not met, if the subject's performance warrants supervision, or if the subject touches an external support or receives assistance from the examiner.
- Subjects should understand that they must maintain their balance while attempting the tasks.
- The choices of which leg to stand on or how far to reach are left to the subject.
- Poor judgment will adversely influence the performance and the scoring.
- Equipment required for testing are a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5 and 10 inches (5, 12 and 25 cm).
- Chairs used during testing should be of reasonable height.
- Either a step or a stool (of average step height) may be used for item #12.

1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hands for support.

( ) 4 able to stand without using hands and stabilize independently

( ) 3 able to stand independently using hands

( ) 2 able to stand using hands after several tries

( ) 1 needs minimal aid to stand or to stabilize

( ) 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding.

( ) 4 able to stand safely 2 minutes

( ) 3 able to stand 2 minutes with supervision

( ) 2 able to stand 30 seconds unsupported

( ) 1 needs several tries to stand 30 seconds unsupported

( ) 0 unable to stand 30 seconds unassisted

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely 2 minutes

( ) 3 able to sit 2 minutes under supervision

( ) 2 able to sit 30 seconds

( ) 1 able to sit 10 seconds

( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands

( ) 3 controls descent by using hands

( ) 2 uses back of legs against chair to control descent

( ) 1 sits independently but has uncontrolled descent

( ) 0 needs assistance to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chairs(s) for a pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands

( ) 3 able to transfer safely definite need of hands

( ) 2 able to transfer with verbal cueing and/or supervision

( ) 1 needs one person to assist

( ) 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely

( ) 3 able to stand 10 seconds with supervision

( ) 2 able to stand 3 seconds

( ) 1 unable to keep eyes closed 3 seconds but stays steady

( ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding.

( ) 4 able to place feet together independently and stand 1 minute safely

( ) 3 able to place feet together independently and stand for 1 minute with supervision

( ) 2 able to place feet together independently but unable to hold for 30 seconds

( ) 1 needs help to attain position but able to stand 15 seconds with feet together

( ) 0 needs help to attain position and unable to hold for 15 seconds

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the finger reaches while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

( ) 4 can reach forward confidently >25 cm (10 inches)

( ) 3 can reach forward >12 cm safely (5 inches)

( ) 2 can reach forward >5 cm safely (2 inches)

( ) 1 reaches forward but needs supervision

( ) 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper which is placed in front of your feet.

( ) 4 able to pick up slipper safely and easily

( ) 3 able to pick up slipper but needs supervision

( ) 2 unable to pick up but reaches 2-5cm (1-2 inches) from slipper and keeps balance independently

( ) 1 unable to pick up and needs supervision while trying

( ) 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: Turn to look directly behind you over toward left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

( ) 4 looks behind from both sides and weight shifts well

( ) 3 looks behind one side only other side shows less weight shift

( ) 2 turns sideways only but maintains balance

( ) 1 needs supervision when turning

( ) 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

( ) 4 able to turn 360 degrees safely in 4 seconds or less

( ) 3 able to turn 360 degrees safely one side only in 4 seconds or less

( ) 2 able to turn 360 degrees safely but slowly

( ) 1 needs close supervision or verbal cueing

( ) 0 needs assistance while turning

12. PLACING ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.

( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds

( ) 3 able to stand independently and complete 8 steps in >20 seconds

( ) 2 able to complete 4 steps without aid with supervision

( ) 1 able to complete >2 steps needs minimal assist

( ) 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width)

( ) 4 able to place foot tandem independently and hold 30 seconds

( ) 3 able to place foot ahead of other independently and hold 30 seconds

( ) 2 able to take small step independently and hold 30 seconds

( ) 1 needs help to step but can hold 15 seconds

( ) 0 loses balance while stepping or standing

14. STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding.

( ) 4 able to lift leg independently and hold >10 seconds

( ) 3 able to lift leg independently and hold 5-10 seconds

( ) 2 able to lift leg independently and hold = or >3 seconds

( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently

( ) 0 unable to try or needs assist to prevent fall

TOTAL SCORE (Maximum = 56: _____

Timed Up and Go (TUG) Test

Name:_____ MRN:_____Date:_____

1. Equipment: arm chair, tape measure, tape, stop watch.
2. Begin the test with the subject sitting correctly (hips all of the way to the back of the seat) in a chair with arm rests. The chair should be stable and positioned such that it will not move when the subject moves from sit to stand. The subject is allowed to use the arm rests during the sit – stand and stand – sit movements.
3. Place a piece of tape or other marker on the floor 3 meters away from the chair so that it is easily seen by the subject.
4. Instructions: "On the word GO you will stand up, walk to the line on the floor, turn around and walk back to the chair and sit down. Walk at your regular pace.
5. Start timing on the word "GO" and stop timing when the subject is seated again correctly in the chair with their back resting on the back of the chair.
6. The subject wears their regular footwear, may use any gait aid that they normally use during ambulation, but may not be assisted by another person. There is no time limit. They may stop and rest (but not sit down) if they need to.
7. Normal healthy elderly usually complete the task in ten seconds or less. Very frail or weak elderly with poor mobility may take 2 minutes or more.
8. The subject should be given a practice trial that is not timed before testing.
9. Results correlate with gait speed, balance, functional level, the ability to go out, and can follow change over time.

Normative Reference Values by Age

Age Group	Time in Seconds (95% Confidence Interval)	
60-69 Years	8.1	(7.1-9.0)
70-79 Years	9.2	(8.2 – 10.2)
80 – 99 Years	11.3	(10.0 -12.7)

ANNEXURES III

Master chart

Group - I

S.No	GROUP	AGE	SEX	SIDE OF WEAKNESS	TYPE OF STROKE	BBS - PRE	BBS – POST	TU & GT - PRE	TU & GT - POST
1	A	54	F	L	I	53	56	16.12	15.39
2	A	58	M	L	I	44	50	15.46	8.70
3	A	40	M	L	H	39	47	52.56	51.09
4	A	60	M	R	I	9	21	35.56	25.90
5	A	52	F	L	H	45	55	34.95	32.46
6	A	56	M	R	H	21	36	40.56	33.67
7	A	52	F	R	H	29	44	34.63	26.65
8	A	54	M	L	I	18	32	56.72	53.41
9	A	59	F	L	I	39	50	36.68	32.26
10	A	44	M	L	I	26	40	49.56	44.43
11	A	53	M	R	I	22	37	59.60	55.36
12	A	51	M	R	I	20	35	58.40	54.98
13	A	42	M	L	I	19	34	59.72	52.41
14	A	47	M	R	I	26	41	44.62	38.38
15	A	53	F	L	H	31	46	35.16	30.03

Master chart

Group - II

S.No	GROUP	AGE	SEX	SIDE OF WEAKNESS	TYPE OF STROKE	BBS - PRE	BBS – POST	TU & GT - PRE	TU & GT - POST
1	B	54	M	R	H	38	40	18.38	17.26
2	B	60	F	L	I	24	34	63.51	60.39
3	B	56	M	L	I	31	40	36.70	35.57
4	B	55	F	L	I	23	31	56.73	54.49
5	B	58	F	R	I	10	16	61.10	57.75
6	B	56	M	R	I	31	42	40.56	39.32
7	B	58	M	L	H	8	18	89.90	87.55
8	B	44	F	L	I	27	40	38.67	35.54
9	B	41	M	R	I	33	44	38.90	37.55
10	B	53	M	L	H	20	30	63.59	61.46
11	B	54	M	R	I	9	19	90.06	86.82
12	B	57	M	L	H	29	40	56.72	54.36
13	B	52	M	L	H	22	32	76.18	72.94
14	B	54	F	R	I	34	43	39.46	37.28
15	B	60	M	R	I	10	23	70.09	68.84